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New Hampshire Agricultural Experiment Station

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UNIVERSITY OF NEW HAMPSHIRE

DURHAM, N. H.

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A WORD FROM THE DIRECTORS

THIS 61ST ANNUAL REPORT of the New Hampshire Agricultural Experiment Station presents to the people of the State of New Hampshire and other interested persons the results of our research activities during the fiscal year 1948-49.

The Agricultural Experiment Station is concerned with the basic problems that confront agriculture in our region. It is the desire of the staff to work on those problems that most vitally concern the farmers of the state and continually we solicit your suggestions as to what appear to be the most important problems.

You will note that the cover of this bulletin shows a high-bush cultivated blueberry plant with the fruit ready for picking. This serves as an example of what we are trying to do. Here is a crop that is particularly well adapted to our soils and climate It can stand improvement with regard to winter hardiness and we are attempting through our plant breeding program to develop a variety even better suited to our climate. As with blueberries, so with vegetables and other fruits, we are continually developing new strains and varieties that better suit our needs It is hoped that you will read this report and become acquainted with the latest developments in agricultural science.

ROBERT F. CHANDLER, JR.
Director

HAROLD C. GRINNELL
Associate Director

Agricultural Chemistry

The Products of Sucrose Hydrolysis in Strawberries Influence the Determination of Ascorbic Acid. In strawberries which are packed for freezing without sweetening, hydrolysis of the sucrose present in the berries at harvest time takes place during frozen storage. In berries which are packed with syrup, hydrolysis of both the original and added sucrose occurs. The determination of ascorbic acid in the stored berries is influenced by the end products of this hydrolysis and also by the presence of naturally occurring dicarboxylic acids. Progress is being made on a method of ascorbic acid determination which will not be influenced by these interfering substances.

S. R. Shimer
H. J. Purinton

Enzyme Studies with Squash. The presence of phosphorylase in each of the three common species of cucubita has been proved. Weak anylase activity appears to be present also. The pectin content of the material seriously interferes with the separation of the enzymes.

T. G. Phillips

Biological Assay Methods Prove Useful in Measuring the Amounts of Water-soluble Vitamins. It has been determined that the *Lactobacillus arabinosus* assay for nicotinic acid, the *L. fermentum* method for thiamine, and *L. Casei* procedures for riboflavin and pantothenic acid are applicable to the quantitative determination of these vitamins in urine, feces, and milk. Consequently, they are of considerable value in excretion studies. Since sulfonamides are often employed in such experiments, the effect of the compounds upon the assay procedures was studied. It was found that certain sulfonamides, if present in sufficient concentration, inhibit growth of the organisms, but that this inhibition can be prevented by increasing the amount of p-aminobenzoic acid in the basal medium.

A. E. Teeri

The Carboyhdrates of Pasture Grasses. The carbohydrate content of various pasture grasses throughout the growing season is being studied. Although a more complete report will be made in another year or two, some findings are worthy of mention at this time.

The sucrose content varied among species from a low of 2 per cent in Kentucky to a high of 13 per cent in brome grass, both at the dough stage. Fructosan was present in five species but was absent in alta fescue, brome, and orchard grass, the tops only being sampled.

In all the species except timothy, protein correlated negatively with both cellulose and lignin while the latter two correlated positively with one another.

During the growing season, protein decreased significantly between any two successive sampling dates. Protein differences between species were usually significant at the same physiological stage of maturity, reed canary and brome being the highest and timothy the lowest. Reed canary also was highest in soluble ash and lowest in lignin. Comparisons at the same date often gave different relationships than comparisons at the same stage of growth.

T. G. Phillips
M. E. Loughlin
S. Roseman

The Zscheile Method Proves Best for Determining Carotene in Foods. As a result of investigations during the past three years, it has been shown that the Zscheile method is more applicable, over a wider range, than any other method tried. This method worked with any of the tested food materials which included fresh fruits and vegetables, fresh plant tissue, canned foods, frozen foods, and dried products. Slight modifications of the method are required in applying it to dried foods.

H. J. Purinton

Vitamin C in Canned Vegetables. County and home demonstration agents in Coos, Merrimack, and Cheshire counties collected samples of home-canned tomatoes, green and yellow beans, corn, and carrots, totaling 405 jars. These samples were sent to the University of New Hampshire to be analyzed to see what amounts of certain important nutrients are contained in home-canned produce in this state.

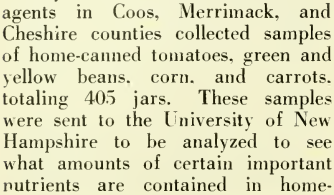

Fig. 1 — Checking samples of home-canned fruits and vegetables as they came in for nutritive value studies.

To date, all the tomatoes (129 samples) and green beans (75 samples) have been analyzed for ascorbic acid (vitamin C), one of the important nutrients.

The ascorbic acid content of a pint of tomatoes ranged from 3 to 103 mg. and 70 per cent of them were within the range of 31 to 70 mg., which is considered by most authorities as being within the range of the daily requirement of an adult for this vitamin. These values compare reasonably well with figures quoted for commercially-canned tomatoes, and tomatoes processed by ordinary home methods but under rigidly controlled conditions. Home canned tomatoes from Cheshire and Merrimack counties contained, on the average, more ascorbic acid than those from Coos county. Many factors, such as variety, soil, and maturity, influence ascorbic acid content of foods, but complete data on all these points are not available. Therefore, no explanation for these variations is possible.

The ascorbic acid content of green beans ranged from 0-97 mg. per pint with 50 per cent of them being within the range of 11 to 40 mg. per pint. This is a somewhat lower range than figures for commercially-canned products but compares very favorably with values for home-canned beans, processed under rigidly controlled conditions.

Samples from Merrimack and Coos counties, on the average, contained more ascorbic acid than those from Cheshire county. Again, too many variables are concerned to allow full explanation. Four samples contained *no* ascorbic acid.

S. R. Shimer
H. J. Purinton

New Frozen Food Containers Prove Highly Satisfactory in Preventing Moisture Losses. A continuous supply of new types of containers for use in freezing fruits and vegetables is reaching the consumer market. The usefulness of each type must be tested by determining how well it safeguards the packaged food. The ideal container must be moisture-vapor proof ("leak-proof") to prevent changes in the quality of the product it contains. During the past

five years, several types have been tried in connection with various frozen food projects at the University of New Hampshire. Prior to the present year's studies, the only container which proved entirely satisfactory was a heavily paraffin-coated box, prepared by hand-dipping an ice-cream carton in melted wax.

This year 14 new types of containers, which are available to the public, have been tested. Nine of them were used for storing frozen squash. Only one of the nine types showed any appreciable loss in weight over a six-month storage period. Five additional new types have been used in the storage of berries, frozen in a syrup medium. No appreciable changes in weight were noted over a ten-month storage period.

H. J. Purinton

The Cobalt Content of Hay Can Be Increased by the Application of Cobalt to the Soil. The cobalt content of timothy grown on a Paxton soil was raised from a low level of 00.3 ppm to 0.41 ppm by the addition of 2 lbs. of cobalt per acre and to 0.93 ppm by the addition of 5 lbs. of cobalt per acre. Applications of nitrogen increased the yield but decreased the phosphorus, cobalt, and manganese content. Liming decreased both the cobalt and manganese content. Applications of potassium increased the manganese content.

G. P. Percival
Dorothy Josselyn

Agricultural Economics

How Many Man Minutes Are Necessary To Do the Daily Routine Winter Chores on a Herd of 40 Cows? Data taken on five very efficient farms during the year indicate that in a modern stable good managers are doing the daily routine of winter chores in 450 to 500 man minutes. A few are doing these tasks in about 325 man minutes. With the elimination of unessential practices, and the adoption of simplified procedures, some of the operators may cut chore work in the next few years to as low as 280 man minutes for 40 cows. This is seven man minutes daily per cow. These data do not include labor on care of milking equipment.

The operation of feeding took a little over 100 man minutes for 40 cows on four farms and less than 50 minutes on the fifth farm. Roughly, a third of the total feeding time was used in preparation or getting feed from storage to the stable ready to feed. Considerable progress is expected in the future in this phase of the feeding operation.

One operator spent 29.9 man minutes sweeping in front of the cows. This procedure can be reduced to about six minutes by the elimination of unessential practices and the substitution of special low-cost equipment for the narrow broom. Total feeding time can be reduced to 40 man minutes on some farms.

The disposal of manure and cleaning back of the cows, including spreading of sawdust for bedding, took from 70 to 90 man minutes where combination truck-carrier equipment was available. One operator, who had improvised a home-made gutter cleaner and had sawdust stored overhead, did the work in 56 man minutes. The use of a special sweeper reduced the time needed to clean the alleyway back of the cows on one farm from 3.10 to 0.48 man minutes.

Fig. 2—Feed swept to cows in 4.80 man minutes (above). Feed scraped to cows in 0.45 man minutes (below).

The greatest saving in time has been in the improved methods of milking. This phase has been reported previously in Station Circular No. 76.

H. C. Woodworth, K. S. Morrow, and E. M. Elliott

Some Problem Cows Can Be Trained. During the year, 13 cows were subjected to special treatment because a long time was required in order to complete the milking process. At the end of the experiments (which varied from three to four weeks) three cows were milking out in four minutes and three others were milking in 4.5 minutes or less. The other eight cows did not respond satisfactorily although the total time of four of them was reduced over one minute. The average milking time of the six cows making a good response to treat-

Fig. 3 — Manger swept in 4.50 man minutes (above). Manger swept in 2.45 man minutes (below).

Fig. 4 — Gutter alleyway swept in 3.10 man minutes (above). Gutter alleyway scraped in 0.48 man minutes (below).

ment was reduced from 6.3 to 4.2 minutes. The seven cows with unsatisfactory response were reduced from 7.3 to 6.1 minutes.

These data indicate that about 40 per cent of the problem cows, provided they are not over eight years of age and have normal healthy udders, can be trained to milk out satisfactorily.

The chief difficulty in milking quickly was found to be the operator's failure to get back to the cows at the end of three minutes of milking and massage the udder in the process of machine stripping. Some cows give down about 75 per cent or more of their milk in the first three minutes, and then the milk flow is retarded. If the oper-

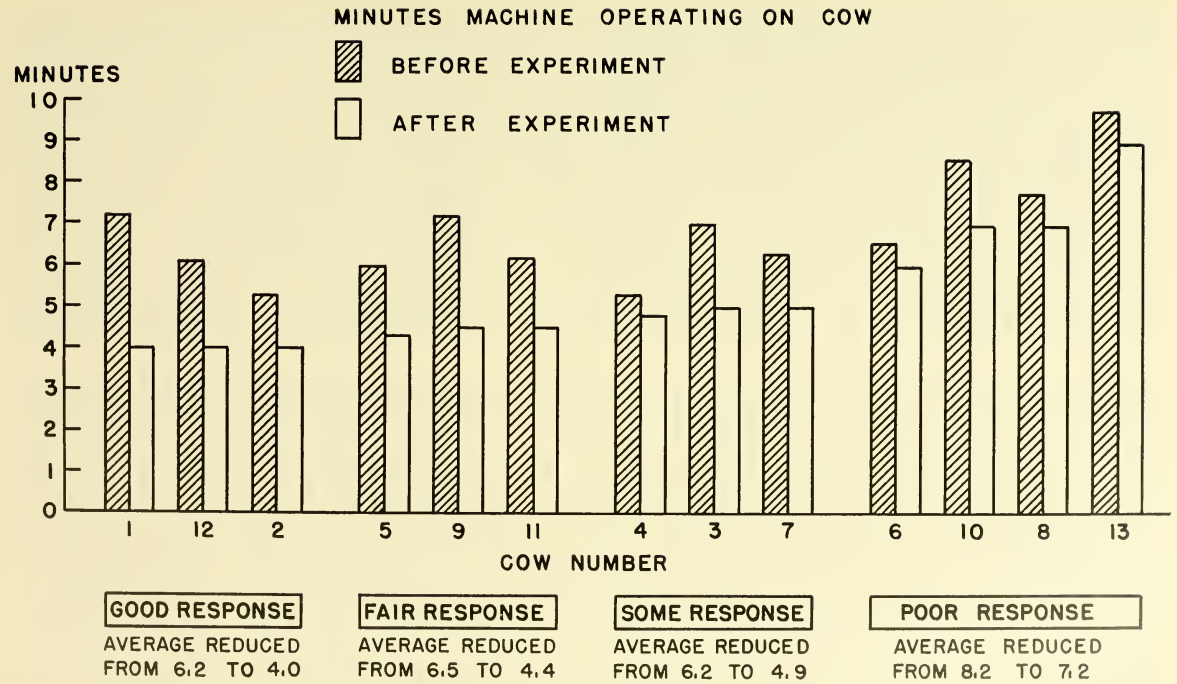

Fig. 5 — This chart shows the response of 13 cows to special treatment designed to induce better let-down of milk.

ator is persistent in getting back to these cows at the end of three minutes of milking and does a thorough job of machine stripping for one minute, some of these cows will respond with satisfactory letdown.

One herd, where the records indicate that machines were left on half the cows over eight minutes, was subjected to the following experiment.

Arrangements were made for the operator to do a thorough job of preparing and getting back to the cows at the end of three minutes to machine strip. Machines were taken off in all cases at the end of four minutes. All cows were hand stripped and the strippings were weighed. Twenty out of 28 cows had less than one pound of strippings. The cows were rearranged so that these 20 cows were milked first. The next day these cows were milked out by machine in four minutes. The machines were left on the other eight cows for five minutes and the strippings weighed. Three cows were definite problem cows and because of age and unsound udders probably would not respond to treatment.

Many records taken of the rate of milk flow at half-minute intervals indicate a great variation. One cow with production of 27.6 pounds at one milking gave 6.8 pounds at half-minute intervals. At the other extreme, one cow with production of 21.2 pounds of milk at one milking did not exceed two pounds in any half-minute interval.

H. C. Woodworth, K. S. Morrow, and E. M. Elliott

A Study of Milk Marketing Problems in Small Towns. The market supply of milk for six small towns in New Hampshire is being studied in some detail. The majority of the towns selected for study are deficit in terms of local supplies and demand, particularly in the holiday seasons. This condition has raised questions of capacity of local dealers and of their ability to carry the risk of fluctuating demands as compared with larger dealers who supply a more varied market.

Investigations have shown a considerable cross hauling of milk supplies and deliveries of small amounts by larger dealers from distant points which could be more economically consolidated with one consignment.

In most areas there has been a significant decline in the number of small producer-distributors with a consequent increase in the amount handled by dealers. There are various reasons for this decline, including retirement, delivery to dealers, working in industry, switch to poultry farming, disease in herd, and others.

The study emphasizes spatial relationships between consumers and producers and the influence of competitive bidding for supplies on distribution efficiency.

J. R. Bowring
J. C. Holmes

Opportunities on Idle Farm Land. This project was started in April 1948 in response to concern, on the part of farmers and others interested in New Hampshire agriculture, that some good farm land as well as bad was lying idle and growing up to brush. The study, so far, has covered 20 towns, including at least one in every county of the state. Some description of the idle farm land has been obtained in all 20 towns. It should be stressed here that we are referring only to idle land believed by informed local people to be as good as other land which is being successfully farmed. In three of the towns we have also interviewed both the owners of the idle land, to learn their attitudes toward having their land used, and the active farmers to discover their

needs for land and the conditions under which they could use it.

The Principal Findings. The towns studied so far indicate that, in most towns which have considerable agriculture, we could expect to find from a dozen to two dozen idle pieces of farm land, ranging from full commercial family-size farms down to a single small field. Not all these farms are entirely idle. On some the hay is cut or a small amount of stock is pastured; but not enough farming is being done to keep hay and pasture from running out and brush from coming in.

Most of the owners of these places (particularly the larger ones) indicate willingness to have their farm land used, sometimes for very little rent. However, they often are not willing to make needed improvements. Several of the more active farmers in these towns indicated interest in using the better, more convenient idle land, and expressed willingness to make some improvements that were needed to grow good crops provided they could get long-term leases with low rent.

How Farmers Might Profitably Use Land Now Idle. Developments in agricultural methods are making it possible for a farmer to handle a larger farm business. As some farmers develop larger businesses others must follow or their incomes will suffer. With good land and equipment one active man with some haying help can handle 20 or more cows, yet many farms have well below 20 cows, a condition which may be due to lack of hay and pasture on the home farm. In such cases, the farmers could well explore the possibility of renting land now idle. If a farmer is not able or willing to buy hay so that his choice is between a 10-cow herd or a 20-cow herd, fed partly from rented land, the renting of additional land may add considerably more to his income than the market value of the hay produced on it.

Another type of farmer who might profit from arranging for the use of some of these idle places is the young man who is trying to get started. Today some kinds of farming require considerable capital. One way partially to overcome this barrier to getting started is to rent a farm or a part of the land used. Even if the young farmer has the required down payment to buy a farm on a mortgage he might well consider, at present, whether or not it might be better to rent for a time and see where prices are going.

Although there is some idle land which might be leased, we must be careful to keep in mind that a poor farm will not make money for a renter any more than for an owner and that a poor job of farming will not make money on a rented farm any more than on one's own farm. In renting we need to be very careful that the terms of the lease provide conditions favorable for both owner and renter in order that they may do what is necessary for a good job of farming. Provisions for either the owner or the renter to make needed improvements such as liming, seeding, and repairing fences and building are especially important. Generally speaking, the owner should make those improvements which increase the value of his property. However, as many owners of idle farm land in New Hampshire are not farmers and are not interested in improving the value of their places as farms, it may be necessary for the renter to make the improvements. In order to get the returns from these improvements, the farmer needs low rent and either a lease long enough to get the full benefit of his improvements or a provision that he will be paid for the unused value of improvements.

Fig. 6 — This field, idle except for taking off a light crop of hay, could be made productive by liming, fertilizing, and reseeding.

Often many owners of idle farms are not well acquainted with farming, so it is pretty much up to the farmer who wants land to contact the owner and to make him an offer which the farmer thinks is reasonable. This, of course, applies to buying as well as to renting. Persons who have difficulty in figuring out a fair rent or in drawing up a good lease are urged to contact their County Agricultural Agent or the College of Agriculture, at the University of New Hampshire, for assistance.

W. K. Burkett

Crops and Pastures

Hybrid Corn Maintains Its Superiority. In 1948, in New Hampshire, there was more planting of hybrid corn for silage and grain than ever before. (Over 75 per cent of the acreage would be a reasonable estimate.) In 1936, when the University of New Hampshire Agronomy Department started the corn variety trials, less than 5 per cent of the corn grown in the state was of hybrid origin. Hybrid corn has increased in popularity because it yields higher than open-pollinated corn. It is also subject to less stalk breakage in the field, having stronger stalks, more extensive roots, and resistance to insects and disease. In addition, the parents of hybrids are known and have proved to be superior.

In order to find out what hybrids are best suited for New Hampshire, the Agronomy Department, for the first time, had variety trial plots in various sections of the state, as well

Fig. 7 — This field, entirely idle for a few years, would require considerable labor or the use of heavy equipment in addition to lime, fertilizer, and reseeding to make it productive.

as on the University Farm. Yields of 15-20 tons of silage and 65-70 bushels of grain per acre were not uncommon. Certainly such yields are better than 8-10 tons for silage and 35-40 bushels for grain, which generally occurred with open-pollinated flint varieties back in the 1930's.

The 1948 corn trials brought forth the following observations:

Dent corn hybrids were adapted and continued to yield higher than open-pollinated dents, dent-flint hybrids, and open-pollinated flints.

Cornell 29-3 maintained its place as a high-yielding early silage corn and a late grain corn.

The yields of open-pollinated West Branch Sweepstakes were very variable, because of stalk breakage and differences in strains and sources of seed.

In search of dent hybrids to replace Sweepstakes as a late silage corn variety, Wisconsin 692, although producing a medium percentage of dry matter, was outstanding in yield for the fourth consecutive season. Ohio M-15 generally yielded better than Ohio K-24 because of the slender stalks of the latter.

For grain purposes, the hybrids that mature in a medium-length season of 110-120 days, the Wisconsin hybrids of the 200, 300, and 400 series gave good returns. Mass. 62 again was superior in this maturity group.

In the Connecticut River Valley at Lancaster, the two dent-flint hybrids, Maine B and Wisconsin 240, matured better and yielded 10 bushels higher per acre than did two local flint varieties. In the same field,

Cornell 29-3 and Mass. 62 returned over 7000 lbs. of dry matter to the acre for silage.

At Claremont Junction on the Connecticut River terraces, in spite of late planting in June, corn yields were exceptionally high. Several of the Wisconsin hybrids, Cornell 29-3, Mass. 62, and a new Pennsylvania hybrid, were outstanding

The highest recorded yields of silage corn in New Hampshire were obtained at Durham where two Connecticut Agricultural Experiment Station sweet-dent hybrids produced averages of over 10 and 11 thousand lbs. of dry matter per acre. Generally, 9000 lbs. is considered to be a high yield. Sweet-dent hybrids, although potential silage yielders, should not be used for grain because of the presence of some hard kernels on the ear.

L. J. Higgins

Disease-Resistant Oat Varieties Adapted to the New Hampshire Climate. Disease-resistant oats insure better returns whether they are grown as an annual hay crop, as a nurse crop to be grazed off, or are harvested for grain. Since 1943, when the Agronomy Department of the University of New Hampshire in co-operation with the U. S. Department of Agriculture established the uniform oat trials, the new disease-resistant varieties have not only been accepted in the state but also larger percentages of disease-resistant seed have been planted each year.

In 1948, oat trials identical to those of the University Farm at Durham, were carried on at Lancaster and Claremont. These triplicate plantings were made so as to have oats growing in reasonably important crop areas and to note the effects of differences in climate.

The 1948 oat trials gave the following results:

Oat hybrids of the Bond parentage such as Clinton, Mohawk, Benton, and the Canadian variety Ajax gave good returns in all three areas.

Varieties which are resistant to stem rust and Victoria Disease gave higher yields than did those varieties which are resistant only to crown rust and smut.

The ordinary Clinton variety continued to show considerable variability with numerous drooping heads, while Clinton 59, an improved strain, showed more uniformity and returned better yields.

Dr. F. A. Coffman of the U. S. Department of Agriculture visited the Durham trials and found little evidence of crown rust race 45 which has been harmful to certain varieties including Clinton.

The non-disease resistant and ordinary check varieties gave better returns in the Lancaster area than they did in either of the more southern areas.

Oat forage yields averaged better than five tons to the acre and grain yields were 75 bushels to the acre. Before the disease-resistant varieties were introduced into New Hampshir, yields of 25-30 bushels per acre were considered typical.

L. J. Higgins

New Potato Varieties Show Promise. Ontario. a scab-resistant potato developed in New York State, is one of the most promising new potato varieties that has been tested in the potato variety program. The Ontario yields well, is a good cooking potato, has a certain resistance to late blight, and is exceedingly resistant to potato scab. Tuber unit seed stock was produced in 1947, and again in 1948, to supply in quantity to one certified seed grower in the Colebrook area.

The demand which developed for Ontario seed from growers who were attempting to grow potatoes on land that had been limed, far exceeded the supply of certified seed produced in

New Hampshire and neighboring states. Hence, the future for the Ontario potato seems especially bright, since much land in New Hampshire has been so limed in recent years as to require a scab-resistant variety.

Pawnee, a smooth, white-skinned potato from Colorado, has shown considerable promise as a mid-season variety to take the place of Irish Cobbler. While the Pawnee is not bred for disease-resistance of any sort, it does have the ability to yield well, particularly in the southern portion of the state. Pawnee has smoothness which gives it exceptionally good market appearance, and a high percentage of the tubers are marketable.

Essex is another promising new variety which shows great promise. It has resistance to late blight, as well as a high yielding ability. For the past three years, Essex has outyielded all other varieties in our tests. Tuber unit stock of both Pawnee and Essex are being produced at Colebrook.

Many other varieties are being tested for yield and are being grown in a tuber block at Colebrook. Among these are the Kennebec, a new blight-resistant variety from Maine; B76-43, a variety which gave an exceptionally high yield at Durham in 1948, and others. When it develops with certainty that one of them will give superior performance in this state, it will be released immediately to certified seed producers and thus become available to commercial growers.

P. T. Blood
F. S. Prince

How Do You Like Your Potato Chips? Rapid expansion in the potato-chip industry in the large cities of New England has given New Hampshire potato growers a definite market for potatoes for this purpose. Kennebec, a new variety from Maine, and produced in New Hampshire for the first time last year, made the most satisfactory chips from the standpoint of both color and flavor. Mohawk, a relatively new variety, ran a close second in both color and taste. These two varieties were ranked excellent in our chipping tests.

Other varieties that cooked into good marketable chips were Ontario, Madison, B76-43, and Ashworth. It is interesting to note that none of these six varieties, which ranked high in chip quality, represent the commonly grown varieties, although Katahdin, Chippewa and Cobbler made chips of relatively satisfactory quality.

Chip manufacturers like a potato which will fry into light-colored chips. The color which develops at normal chip-frying temperatures is directly proportional to the amount of reducing sugars in the potato. Some varieties at any storage temperature have more reducing sugars than others, although storage temperatures during the season undoubtedly have their influence on the amount of these sugars present. It is for this reason, however, that Essex, Green Mountain, and a few other varieties do not fry into chips which are in favor with present market demands.

P. T. Blood

Perennial Red Clover Now a Possibility. It has been recognized for a long time that there are many perennial forms of red clover, although farmers usually consider it to be a biennial plant. During the past decade, workers at the University of New Hampshire have been making selections of red clover specimens from old mowings, choosing seed or other parent material from plants that apparently have lived for more than two years. These selections have

been combined into a strain which shows a definite perennial tendency and gives a high yield under New Hampshire conditions.

A system of chain crossing is being used to fix this perennial habit in the progeny, and selections are annually made among the families to eliminate certain diseases. Harvests were obtained in 1949 from seedings of this strain made in 1946 which still show as much as 50 per cent red clover under optimum fertilizer treatment.

Ladino clover and timothy are also being subjected to selection and breeding in this experiment with the objective of developing more desirable strains than are now available.

F. S. Prince

Pasture Renovation Costs Variable. With such a variety of soils as are encountered in New Hampshire, it is not surprising to find that costs of pasture renovation vary widely. Two case studies of pasture clearance in Durham well illustrate this. One of the pieces of land studied was a rocky three-acre strip covered with pasture pine and brush but having excellent soil. The total cost to bring this piece from its original wild condition into relatively stone-free, tillable pasture was $140 per acre. Of this total, $54 represented cash outlay and the remaining $86 was the estimated cost of equipment operation, labor, and materials, available on the farm, including lime and fertilizer.

The second site was on a lighter soil. There, the cost totalled $19 per acre, divided into $7 per acre for disc-tilling and $12 for rock picking and fitting.

While these costs are not directly comparable (because in the first instance fertilizers and lime were included) the observations show much disparity in costs of pasture clearance; so much, in fact, that the final result of this study cannot possibly be in terms of average costs. On the contrary, the cost range in relation to the capacity of the soil to produce good pasture must be the end that is sought. It is hoped that an overall index of New Hampshire soil types as to their relative value for clearing eventually may be achieved.

This project has been a co-operative study between the New Hampshire Agricultural Experiment Station and the Soil Conservation Service.

L. T. Kardos
J. B. Bartlett

Potash, the Limiting Element to Ladino Growth. That potash is the major limiting element to ladino clover growth was confirmed in a greenhouse test last winter. As little as 25 lbs. of actual potash on an acre basis gave a highly significant increase in yield. Additional increments of potash continued to give increases in yield up to 200 pounds of potash per acre. This amount of potash is equal to more than 300 pounds of potash in the muriate form.

Ladino responded also to lime applications up to two tons per acre, although its response even to small amounts of phosphorus was very slight. Some of the minor elements apparently influence ladino yields since a mixture containing boron, copper, manganese, iron, and zinc caused a slight increase in yield. Tests to determine which of these elements are responsible for stimulating ladino growth will be carried on in a continuation of the experiment in greenhouse trials.

A soil of low fertility is being used as a medium in this test, and the test, itself, is preliminary to field tests on pure ladino stands on some of the major soil series of the state.

F. S. Prince, L. T. Kardos, and P. T. Blood

Ladino Superior in Mid-Summer. Botanical separations of pasture forage, produced on land seeded to ladino clover and one of the large grasses, give an indication of the usefulness of ladino clover as a pasture in midsummer. The plots on which the samples were taken were seeded in 1942, 1943, and 1945. The average percentages of grass and ladino at different dates for all plots harvested were as follows:

June	73%	27%
July	54%	46%
August	52%	48%
September	60%	40%

The data indicate that while ladino clover may not amount to more than one-quarter of the total forage in the early part of the season, by July it reaches a total of about one-half of the forage, and drops again during the cooler fall weather to about 40 per cent of the total forage produced.

While the large grasses such as timothy, smooth brome, and orchard grass vary some in their ability to produce forage during the hot summer months, ladino shows up best during July and August, by producing abundant forage then.

F. S. Prince, L. T. Kardos, and P. T. Blood

Fertilizers on the Plow Sole Are Effective. Sweet corn responds as well to fertilizers that are placed on the plow sole as to those that are applied with the planter. A more efficient method, however, is to divide the application and place half the fertilizer on the plow sole then band the other half with the corn planter or band half the fertilizer and apply the remainder as a side-dressing at the second cultivation.

These findings represent the results of four years' work in placing the fertilizers for sweet corn by different methods as outlined. The yields of sweet corn, when fertilized by the four methods, fall into two groups. The higher yields come from the methods where the fertilizer is applied and is placed in a divided application; the lower yields come from the treatments in which the fertilizer is all placed in one application, either on the plow sole or being all applied in bands with the fertilizer attachment on the corn planter. Plow sole application of fertilizer is a relatively new idea and appears to work especially well with corn which has a very strong feeding root system. In view of the newer methods of weed control with 2, 4-D, and other herbicides, there is a distinct possibility of farmers cultivating their own corn fewer times than has formerly been the custom. Because it has been common practice, in sweet corn growing areas, to apply approximately half of the fertilizer at the second or third cultivation it is felt that this project is particularly timely. When it is followed, farmers need not depend upon side-dressing if they wish to omit certain cultivations but can, if they wish, plow half their fertilizer prior to planting with equally good results.

F. S. Prince, P. T. Blood, R. Feuer, and G. P. Percival

Magnesium in Potato Fertilizers Pays Dividends. Three years' results at Colebrook indicate an average dividend of 75 bushels of potatoes per acre each year when magnesium is added to the fertilizer. The quantity of magnesium was relatively small, being equivalent to 40 lbs. of magnesium oxide per acre. Chemical analyses of soil samples from potato fields in the principal potato-producing areas in the state indicate that similar dividends might be expected in many cases. It is interesting to note that of the first 16 of the 34 potato growers who qualified in the New Hampshire 300

Bushel Club, in 1948, all used fertilizers to which magnesium had been added; on the other hand, nine of the last 18 growers did not use such fertilizers. Make sure your potato fertilizer contains magnesium.

F. S. Prince, P. T. Blood, L. T. Kardos, and R. Feuer

Caution Needed in Use of Borax in Potato Fertilizers. It has been definitely established that potatoes need small amounts of boron in order to grow properly. The amount required, however, is very small and injury can result from applying very little more than is needed for good growth. For example, on the Worthington loam soil at Colebrook, which was found to contain an amount of water-soluble boron which was equivalent to 3.7 lbs. of borax per acre, an application of 5 lbs. and of 20 lbs. of borax per acre with the fertilizer in the bands was tried out.

The application of 5 lbs. gave a remarkable increase the first year whereas, the 20-lb. rate stimulated yields but to a lesser degree than the 5-lb. treatment. During the second and third years, continued application of the borax at the two rates showed no increase or a slight decrease in yield for the 5-lb. application and a large decrease in yield for the 20-lb. application.

In another series of plots in which crimson clover as a green manure crop preceded potatoes, the first application of 20 lbs. of borax in the potato fertilizer resulted in a large decrease in yield of tubers. Additional experimentation is necessary to determine the significance of this result; but it would appear that the crimson clover had built up the available supply of boron so that the 20-lb. application was injurious.

In New Hampshire there are some potato soils which are lower in available boron and others which are higher in it than in the soil on which these experiments were conducted. Therefore, a boron diagnosis of each potato farm should be made before definite recommendations can be made for the use of borax in potato fertilizers.

F. S. Prince, P. T. Blood, L. T. Kardos, and R. Feuer

Dairying

Grass Silage Prevents the Loss of Nutrients during Harvesting. The success that a dairyman has in getting his hay crop stored in the best possible condition determines to a considerable extent his net income during the winter-feeding period. In order to learn more about the effects of different methods of storage on the feeding value of a forage, comparable lots were stored in the silo without preservative, were mow-cured without supplemental heat, and were field cured.

On the dry basis the silage contained 2 per cent more protein than the mow-cured hay, while the mow-cured hay contained 1.5 per cent more than the field-cured hay. The silage was also higher in energy. As determined in another experiment, the digestibility of both the protein and energy of the silage, when fed as the sole ration, was considerably lower than that of either of the hays. However, the silage produced much greater gains than either of the hays when fed free choice along with two lbs. per day of a concentrate mixture to growing dairy heifers. This result was obtained in spite of a considerably lower nutrient intake from the silage.

These results indicate the possibility that the full nutritive value of forage which is ensiled without pre-

servative may not be realized when it is fed as the sole ration. This experiment also shows both the value of grass silage in preventing the loss of nutrients during harvesting and its value as a part of the ration.

H. A. Keener, K. S. Morrow, and G. M. Foulkrod

Wood Molasses as Good as Cane Molasses in Dairy Cattle Feeding. A process has been developed at the U. S. Forest Products Laboratory, Madison, Wis., for the production of molasses from wood waste. Yields of 130 to 200 gallons of molasses are obtained from each ton of wood. Briefly, the process consists of converting wood waste to sugar by pressure-cooking with dilute acid and subsequently evaporating the resulting sugar solution to molasses. Because of the high yields of molasses obtained by this process from unused wood wastes such as are found at sawmills, woodworking plants, and in the forests, lumbermen are very much interested in this product.

Because preliminary feeding tests showed that the molasses produced by this process may be used as a substitute for cane molasses for stock feeding, and because of the large amount of wood wastes available throughout New Hampshire, experiments to determine the value of this product and to compare its nutritive value with that of cane molasses for dairy cattle feeding have been carried out. By means of carefully controlled individual protein and energy balance experiments with dairy heifers it was found that wood molasses was equal to cane molasses as a feed for dairy cattle.

N. F. Colovos, H. A. Keener, A. E. Teeri, and J. R. Prescott

Early-Cut Timothy Hay Is High in Protein. Farmers have been advised for many years to harvest their forages early. It generally has been recognized for a long time that the stage of maturity and the texture of the plant are indicative of its feeding value. However, little conclusive experimental evidence appears to have been obtained by nitrogen and energy balance experiments to determine accurately the effect of maturity on the feeding value of various forages. In a series of controlled individual feeding experiments with dairy heifers, using the facilities of the metabolism stalls, the automatic excreta collection devices and the respiration chambers available at the New Hampshire Agricultural Experiment Station, the nutritive value of timothy hay, cut at three different stages of maturity, was determined and compared to clover hay. The early timothy surpassed all the other hays in metabolizable energy but furnished less than half as much digestible protein as the clover hay. The early-cut timothy furnished 3.2 times as much digestible protein and 1.25 times as much metabolizable energy as the late-cut timothy hay.

H. A. Keener, N. F. Colovos, A. E. Teeri, and J. R. Prescott

Aureomycin Proves Highly Effective for the Treatment of Mastitis. A new antibiotic agent, aureomycin, was tested for the treatment of streptococcal and staphylococcal mastitis. This material was supplied for experimental use through the courtesy of Lederle Laboratories, Pearl River, N. Y. The aureomycin was placed in an ointment base in a tube, the end of which could be inserted into the teat canal and the injection made directly from the original container. The results to date indicate that the aureomycin is remarkably effective for the treatment of mastitis and has given better results than any other agent so far tested. One injection of 200 to 400 mg. of aureomycin was sufficient to

cure nearly all cases of streptococcal mastitis. The aureomycin also appears to be highly promising for the treatment of staphylococcal mastitis.

Studies are being conducted on the types and pathogenicity of mastitis staphylococci. They should lead to better methods of diagnosis and control of mastitis caused by these bacteria.

L. W. Slanetz, F. E. Allen, and Ralston Read

Entomology

The European Corn Borer Can Be Successfully Curtailed with DDT. Results of experiments carried on for the past three years in Somersworth and Pittsfield, show that the European corn borer can be controlled satisfactorily with DDT dusts. The tests involved both market sweet corn and canning corn.

It was found that four applications of a 3 per cent DDT dust gave the best results, over 90 per cent of the ears being borer-free. Three applications of the DDT dust gave slightly less than 90 per cent borer-free ears. Control with fewer applications was unsatisfactory. The dust was applied at the average rate of 35 lbs. per acre. This is the equivalent of approximately 1 pound of actual DDT per acre.

Liquid sprays of DDT in oil also were tested. Four applications of DDT oil solution gave approximately 85 per cent borer-free ears.

J. G. Conklin, R. L. Blickle, and W. J. Morse

New Insecticides Have Many Uses. The application of parathion in the calyx, and first and second cover sprays appears to have given good control of the red-banded leafroller on apples. Some injury to the foliage has occurred with the calyx application. Rhothane wettable powder, Rhothane emulsion, and two new compounds, No. 118 and No. 1189, also gave rather promising results against the first brood of the leafroller without causing any apparent injury to the foliage of young fruit.

Parathion at the rate of 1½ lbs. of 15 per cent wettable powder has given satisfactory control of the eye-spotted budmoth in commercial orchards.

Limited tests with a new miticide known as Arathane are being made during the current season. The material may have promise in control of orchard mites and mites infesting vegetable and ornamental crops.

J. G. Conklin, R. L. Blickle, and W. J. Morse

Better Insect Control with Nicotine Sprays. Certain chemical compounds, when added to nicotine sprays, will increase the kill and thus result in better insect control. This year, 165 compounds have been tested. Of this number 25 compounds were found to increase the toxicity of nicotine sprays when used against aphids. These materials are termed synergists and are added to nicotine sprays in small amounts. The following compounds increased the kill when added to nicotine sprays at the rate of one part of the synergist to 4,000 parts of the spray material: Dibutyl hexahydrophthalate, tributyl phosphate, and butyl fumarate.

In the course of experimental work it was found that one compound was rather highly toxic in itself when used against aphids. In fact, it appears to be somewhat more toxic to aphids than is nicotine used at the same concentration. This compound has the formidable name

of 1-butyl-4, 4-dimethyl-2-(1-ethylhexyl)-imidazolidine.

J. G. Conklin, R. L. Blickle, and W. J. Morse

Insect Records Show What Harmful Insects Are Particularly Numerous during the Year. In the summer of 1948, grasshoppers occurred in destructive numbers in localized areas in New Hampshire. Two principal species were concerned: the lesser migratory grasshopper, and the red-legged grasshopper.

The eye-spotted budmoth and the red-banded leafroller caused moderate to severe damage in commercial apple orchards in the southern part of the state. There are indications that the use of modern, mechanized spray devices may be a contributing factor to the increase in these two orchard pests.

The Japanese beetle has reached the point where very heavy feeding is noticeable, particularly in the cities of Keene, Concord, and Dover.

J. G. Conklin

Studies of Forest Insects. Examination of the permanent spruce budmoth observation plots revealed that up to this time this insect is showing no tendency to build up in New Hampshire.

The outbreak of the bronze borer apparently has come to a standstill; in fact, it appears to be decreasing somewhat in intensity.

A survey, conducted in areas which had been burned over during the summer of 1947 and which had been re-planted with white and red pine, showed extensive damage by the pales weevil. In some cases as many as 80 per cent of the planted seedlings had been completely destroyed by the fall of 1948.

Work on this project during the ensuing year will include an investigation of chemical control of the white pine weevil.

J. G. Conklin

Pales Weevil Damage to Conifers. Ten plots of 100 transplants each were established in the Rochester Fire Area in the spring of 1948. Nursery stock consisting of white and red pine was provided by the State Forestry and Recreation Commission.

The plots have been examined periodically since planting, and several field inspections have been conducted for the benefit of interested persons.

There is considerable variation among the plots in the number of trees killed. The damage observed one year from the date of planting was 75 per cent of the trees in one plot killed and all but two of those which survived showing injury.

On the other hand, only four trees have been killed in another part of the burned area under conditions which appear to be somewhat similar.

In general, however, the damage is around 40 per cent to 50 per cent of the trees killed. The presence of near-by pine trees, each one a foot or more in diameter, usually indicates an area of active feeding. Feeding has been observed this spring, though lighter than last year.

New plantings have been made in the same areas and observations will be continued for at least another year.

L. C. Swain

Forestry

The Sugar Content of Maple Sap Varies Considerably from Tree to Tree. An attempt was made to measure the total sap production of each tree; but this attempt was only partially successful because of un-

satisfactory equipment and lack of time. No data were collected on changes in the rate of flow as influenced by the weather.

The sap of 48 of the trees was tested for sugar content, with the following results:

Sugar Content	No. of Trees
0.5 — 0.9%	1
1.0 — 1.4	
1.5 — 1.9	6
2.0 — 2.4	22
2.5 — 2.9	11
3.0 — 3.4	4
3.5 — 3.9	2
4.0 — 4.4	
4.5 — 4.9	2
Total	48

Not all the trees in that area were tapped, but it is evident that there is material present to permit studying the influence of weather on sap flow in several classes of trees.

C. L. Stevens

Hop Hornbeam Makes Good Peavy Handles. Hop Hornbeam *(Ostrya virginiana)* is sometimes called leverwood because of its toughness which adapts it for use as pry bars. It is used to a limited extent commercially, but ordinarily it is cut as fuelwood. Unless carefully dried it tends to check badly. Occasionally, peavy handles are made of hop hornbeam and are highly regarded because they stand up so well under the roughest kind of treatment. Twenty-five peavy handles were hand-turned, 17 of them from bolts cut in the near-by woods, and were turned immediately. The other bolts had been previously cut and dried.

Green wood turns more easily than dry wood, and can be seasoned without checking if it is thoroughly coated either with commercial wood sealer or with ordinary varnish. Defects in the wood are not easily seen until they are partly turned. If serious defects appear, the bolt is immediately discarded with little loss of time and handling. When the bolts are dried previous to turning, both time and storage are involved before a defective piece is finally thrown away. The amount of defect observed in the study was 25 per cent.

Dry turned bolts do not need sealing treatment, but because of checking, often must be cut off at the ends by several inches before turning. Shrinkage must be taken into account when the wood is turned green so that a well-fitting handle will result.

L. C. Swain

Chain Saws Speed Up Thinning Work in White Pine Plantation. It takes 52.5 man-hours to cut and pile 6.5 cords of four-foot pulp wood as a thinning operation in a 35- to 40-year-old white pine plantation. This was determined by a time study where four University of New Hampshire seniors did the actual work. The pine stand covers an area of 1.06 acres.

A 90-pound, six horsepower chain saw was used in felling and for a part of the bucking. Nearly as much time was taken in getting the tree to the ground after cutting as in the actual cutting time. For example, 10.3 seconds are required to cut the average tree and 8.9 seconds to get it into position for bucking. An extra man with a push pole speeds this job considerably.

Limbing was not difficult as the branches were small. This operation took 1.9 minutes per tree.

With the chain saw, the average tree was bucked into four-foot lengths in 1.6 minutes. It required 7.4 minutes for one man with a bow-type pulp saw to do the same job. The men quickly tired while using the chain saw and the cuts were broomed on the small diameter pieces.

Newly developed one-man chain saws, weighing around 40 pounds, should make the job of felling and bucking somewhat easier and less expensive.

Studies on three other plots of somewhat similar nature are in progress. The total acreage on the three plots is 21.34.

L. C. Swain

Fruits and Vegetables

Hay Mulch in the Sod Orchard Pays Dividends. Young McIntosh trees mulched with hay produced twice as much fruit in 1949 as did either unmulched or sawdust mulched trees in the same orchard. By standard quick-test methods it was found that available nitrate-nitrogen, magnesium, potassium, calcium, and phosphorus were present in greater amounts in the top six inches of soil under hay than under either sawdust mulch or unmulched sod. On the other hand, when trees were mulched with seaweed, the amounts of available nitrate-nitrogen and magnesium in the soil were even higher than under hay mulch, a condition which was reflected in the extreme dark green color of the foliage and by the delayed maturity of the fruit. It was also noted that some foliage injury resulted from this treatment. Therefore seaweed is not recommended as an orchard mulch.

In general, growers have been under the impression that the use of sawdust as a mulch may unduly increase soil acidity, to the detriment of the trees. It was found, however, that sawdust has had no different effect on soil acidity than hay mulch or sod without mulch.

L. P. Latimer
G. P. Percival

Can High Concentrations of Carbon Dioxide Gas Be Maintained in the Average Common Cold Storage Plant for a Short Period of Time? Rhode Island experiments have shown that concentrations of around 50 per cent carbon dioxide in storage air can lengthen considerably the time during which some varieties of apples can be kept in saleable condition.

The walls and ceiling of the common cold storage plant at the University of New Hampshire are lined with asphalt-impregnated cork block and concrete mortar, and the floors are of concrete. Experiments in this storage show, however, that it is impossible to maintain above 21 per cent carbon dioxide in the air inside for more than two or three hours. This is because of the permeability of those walls through which the gas escapes. This indicates that before attempting to use any ordinary plant for gas storage of apples, for even a short period, it will be necessary first to gas-proof the walls, ceiling, floor, and doors in order to maintain the uniform concentration desired.

Russell Eggert

Hay and Sawdust Mulches Maintain Uniform Soil Temperature around Apple Roots. During the exceptionally hot week of August 23-29, 1948, maximum air temperatures were 84°, 98°, 102°, 96°, 98°, and 94° F., and mimimum air temperature ranged from 53° to 75° F., while the air temperatures at the surface of unmulched soil rose to a peak of 123° F.

On February 12, 1949, when air temperature dropped to -11° F., the temperature under both hay and sawdust mulches remained at 32° F.

Russell Eggert

Aluminum Foil Wrappers Can Be Used to Reduce Sun Scald of Tree Trunks. During the clear winter days of bright sunlight and no wind (February 20 and 24, 1949) air temperatures were 45° and 38° F. respectively. Temperatures in the cambiums on the south side of uncovered tree trunks rose to 72° and 67° F., while those in the cambiums of tree trunks which were wrapped with alumni foil were only 42° and 37° F. at the same time. This indicates that alumninum foil, a material which is easy to apply and to remove, may be an exceptionally good material to use in preventing winter sunscald of tree trunks.

Russell Eggert

New Varieties of Apples Look Promising. Among the new apple varieties on trial at the University of New Hampshire Horticultural Farm, the following appear to warrant further trial, and have replaced the remaining Baldwin trees in the experimental orchards.

Fireside — harvested September 26. A Minnesota variety; light red striped in color; medium good in quality; stores well.

Franklin — harvested October 14. Not a large apple; solid red in color; smooth skin; good good quality; stores well.

Two other varieties which show promise are Sharon and Carlton.

Those varieties still on trial, but which have not as yet been satisfactory under conditions at the Horticultural Farm are: Minjon, Haralson, Joan, Joyce, Newtosh, Keetosh, Victory, Webster, and Wedge.

Russell Eggert

A Cultivating Attachment Adapted to Many Jobs on Small Farms. A cultivating attachment which was developed at the University of New Hampshire Horticultural Farm has been found extremely useful in cultivating wide-row crops, squash, and raspberries, and is especially adapted to prepare small areas for planting. Its particular advantages are the sufficient spread of the shovels to reduce clogging with trash; its ability to cultivate out all tracks left by a tractor; the facts that it can be set any desired depth, and that the shovels on spring teeth eliminate breakage on stony ground.

Russell Eggert

Sprayer Duster Experiments. A comparison of the sprayer-duster, a machine which applies a wet dust, and the regular high-pressure spray machine for scab control showed that where enough material was used to obtain good coverage, the control was similar (less than 1 per cent scabby fruit), with both machines when using the finer particle size dusts. Where a 325 mesh sulfur was used, 24 per cent of the fruit showed scab.

The importance of thorough coverage in scab control was well illustrated by taking records of scab injury on different sides of the trees. Where the 325 mesh sulfur was used, 76 per cent of the fruit nearest the duster was free from scab while that part of the tree farthest from the duster while driving by produced fruit only 24 per cent clean. Where the finer particle size dust was used, none of the fruit showed scab on the part of the tree nearest to the duster while only 76 per cent was free from scab on the part of the tree farthest from the duster.

A sticker in the water used to wet the dust did not improve the scab control.

A concentrate of naphthalene acetic acid in oil was applied as a mist, using the sprayer part of the sprayer-duster to delay the drop of McIntosh. One pint, one quart, and

two quarts of the material were applied per tree. An average of 2.5 apples dropped per day on the treated trees for the 10-day period following the application. Where naphthalene acetic acid was applied as a spray at the rate of 10 gallons per tree, an average of 4.2 apples dropped per day, and where no materials were applied, 14.8 fruits dropped per day. The fruit on the check trees was dropping at the rate of 34 on the ninth day compared to two on the trees treated with the concentrate.

RUSSELL EGGERT

A New Sprayer and Attachments Give Exceptionally Rapid and Thorough Coverage. An Arlington sprayer equipped with a 35-gallon a minute pump, Wisconsin air-cooled engine, and Hardie Sprayrite boom has been slightly altered and, as set up now, gives exceptionally good coverage on large, medium, or small trees. It can be operated by two or three men as desired. A reduction in number of nozzles on the boom permits attachments of a long-handled four-nozzle broom which is operated from the barrel on top of the tank. This broom carries 11/64-inch holes in all discs; it will spray against considerable cross-wind and is used to cover the tops and centers of medium to large trees. Either boom or broom may be shut off as desired.

RUSSELL EGGERT

Apple Picking Platform Has Possibilities. Apple growers recently have become interested in devices which are better than a ladder to aid apple pickers in harvesting the fruit. Many suggested devices are expensive and complicated, but not sound economically. Under the best of conditions a picker can harvest only a limited number of boxes of apples in a day. Therefore it would be more economical to hire more pickers than to tie up expensive equipment or to make large investments.

With this in mind, a horse rake was used as the basis for constructing a simple, inexpensive piece of equipment light enough to be moved about the orchard by hand. The accompanying photograph shows this picking aid which was used with considerable success during the last harvest season and which could well provide the basis for an improved piece of equipment.

The first year's experience indicates that this picking aid should be mounted on large-diameter, lightweight wheels to make it mobile; that the wheels should be far apart to give it stability; that the platform on which the pickers stand should be partly balanced on the axle so the equipment can be easily moved; and that the base sills of the platform should extend out under the tree, spreading as wide or wider than the wheels. As the equipment is very light in weight, it should be

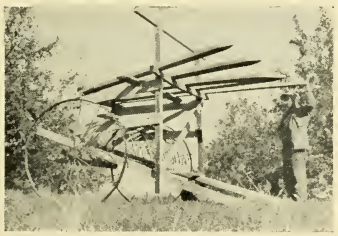

Fig. 8 — An inexpensive apple-picking platform made on an old dump hay rake.

constructed in such a way that when the pickers are on the platform most of their weight will be transferred to the ends of the sills under the tree, thus giving the picking aid stability and rigidity.

The planks on which the pickers stand should be about eight inches wide with a pointed nose so as to slide in and around the branches of the tree. They should be mounted in a fan shape, each plank being flexibly attached so that it may be moved into or out of the tree as well as sideways. This procedure makes it possible to adjust the planks of the picking platform to meet different limb spacings.

W. W. Smith

Giant McIntosh Sport Used as Apple Parent. A sport of McIntosh apple at Roger Kimball's farm in Littleton, Mass., produces giant fruits. It has been shown by U. S. Department of Agriculture workers that this sport has twice the number of chromosomes of the ordinary McIntosh. It is called a tetraploid. Winter Banana apple has the same number of chromosomes as ordinary McIntosh, *i.e.*, 34 or a diploid number.

Crosses of Winter Banana and the Giant McIntosh were successfully made and 400 seedlings from this parentage are being grown. Some of these should be triploids. It is hoped to combine some of the good qualities of the two parents in one variety.

E. M. Meader

Horticultural Work in Northern New Hampshire. In 1948, the University of New Hampshire Department of Horticulture moved its northern New Hampshire experimental plots from Colebrook to the Coos County Farm in West Stewartstown, where we have four acres for vegetable variety trials and 10 acres for orchard and small fruits.

A 600-tree orchard which contains apple, cherry, plum, prune, apricot, and pear varieties as well as some trees to be tried for hardiness as body stock has been set, and fenced to prevent damage by deer.

It is still too early to report results from the fruit planting, but a list of the vegetable varieties best suited for the North Country, as shown by these trials, has been published.

A. F. Yeager
Richard Foley

More Work for Less Money. Plant-breeding operations require the growing of many plants and if all these plants are grown to maturity, a plant-breeding project may be very expensive. For instance, if it is necessary to raise a thousand seedling peach trees to bearing age in order to select a desirable one, several acres of land will be required for a period of years and the cost of fertilizing and maintaining the plants will be heavy.

A discovery made this spring at the University of New Hampshire is of importance, and gives promise of lessening these expenses. It was observed that germinating peach seeds produce sprouts which vary in color from yellow to white. White seedlings are produced by plants which we know will give white-fruited offspring. In our breeding work in many populations we expect about one-fourth of the seedlings to produce yellow fruit at maturity, and the other three-quarters to produce white fruit. Hence, it is now possible to discard three-quarters of the peach seedlings before they come above the ground, thus reducing the cost of our peach-breeding project by nearly 75 per cent.

A. F. Yeager
E. M. Meader

How Tall Should a Raspberry Bush Be? From crosses between ordinary raspberries and *Rubus chamaemorus,* the bakeberry of the northern swamps, we are now getting fruitful, hardy raspberry plants, ranging at maturity from one to six feet in height, with some of the most productive from three to four feet in height. As tall raspberry plants which have the tops cut off lose the best bearing wood in the process, plants which will not require topping are now in sight. These should also be more or less protected by snow during the winter months and may, therefore, be less winter injured. At any rate, we now have the possibility of raspberries produced on any height of plant you wish.

A. F. Yeager

New Hampshire Wild Blueberries Used to Improve Cultivated Varieties. Increased hardiness is needed for blueberry varieties to be fully adapted to New Hampshire conditions. Crosses of a large-fruited, wild high-bush blueberry, found in Loudon, have been made with several of the improved cultivated blueberries from New Jersey and Maryland . Also, crosses of the cultivated high-bush variety, *Pemberton,* have been made with superior wild low-bush blueberries. The F_1 hybrids of this cross proved to be half-high and had dark blackish-blue fruits. In the F_2 generation, of which several thousand seedlings are being grown, good light blue fruits should occur. One thousand unnamed blueberry seedlings, grown and furnished by the U. S. Department of Agriculture, are being grown for a fruiting test at Durham and Gilford.

E. M. Meader
W. W. Smith

Anti-Biotic Being Tested on Squashes. A new anti-biotic derived from the same organism which produces streptomycin has been reported by Michigan State College to be effective in preventing the growth of fungi. This material, actidione, was tried this winter on some Butternut squashes by cutting off at the stem end, dipping in a paste of rotten squash, and then in the actidione solution. While squashes treated in this way finally rotted, decay was delayed for a considerable length of time. Hence, it seems desirable to try this material more extensively another year.

A. F. Yeager

A New, Early Lima Bean Introduced. New Hampshire #51 lima bean has now been named *White Mountain Bush.* This variety is as early as the earliest variety hitherto, but its pods and seeds are as large as late varieties and are produced on low-growing, bushy plants. White Mountain seems to have the ability to germinate in colder soil than most lima bean varieties; hence, it should be adapted to home gardeners in New Hampshire and neighboring states. It was selected from miscellaneous material sent by the U. S. Department of Agriculture several years ago.

A. F. Yeager

Carnival Popcorn Attractive. For a number of years we have been working on a variegated popcorn which produces kernals of many colors, ranging from white and yellow through pink, purple, and black. The variety has now been purified for earliness, shapeliness of ear, and for a reasonable degree of popping quality. Because of its striking appearance, it has been named *Carnival.* It should have value, especially for roadside marketing, as the ears may be marketed for ornamental purposes.

A. F. Yeager

Korean Vegetables Do Well in New Hampshire. Of 145 kinds and varieties of Korean vegetables grown in test plots, several were outstanding for their earliness, good quality, and adaptability to a northern climate.

An Oriental variety of table soybean, which has been named *Pando*, matured green shell beans in 78 days on compact plants about one foot tall. The pods ripened rather uniformly.

One variety of eggplant proved early and extremely productive. The black fruits are long cylindrical in shape. Single plants matured 10 to 12 fruits before frosts. This variety is being called *Korean Long.*

A Japanese watermelon variety called *Shingyamato* matured high-quality, 10-pound melons both at Durham and in Coos County, where a crop of this kind seldom ripens. Selections of this have been named *Colebrook* after the place where the variety was first grown in America. The sweet, crisp flesh of these watermelons is red and the seeds are small and black.

Early muskmelons and cold-resistant, early-ripening cucumbers also proved promising and can serve as valuable sources of breeding material for improved, early vegetable varieties.

E. M. Meader

Weed Control

2,4-D not a Cure-All. 2,4-D, a selective weed killer, is selective not only with crops, but also with weed species. Tests made in 1948 indicated that mustard and white pigweed (two of the most common weeds in oat fields) are easily controlled by spraying with ½ lb. or 1 lb. of 40 per cent 2,4-D acid per acre, but that certain other weeds were not killed by the spray. At these concentrations, young clover plants survived, although they reacted to the 2,4-D. The use of this substance to control weeds in oats at these low rates of application is to be recommended, especially where mustard-like plants and white pigweed are in abundance.

When these rates of 2,4-D were applied to corn, either as a pre-emergence or post-emergence spray, mustard (kale, charlock) and white pigweed were controlled, but red-rooted pigweed, ragweed, and smartweed were not killed. Hence, the plots of corn which were not cultivated, but sprayed only, exhibited a high weed population of these species that were resistant to the herbicide. Work is being continued during 1949 with 2,4-D at higher rates of application. Meanwhile, and until more information is obtained in our climate and on our soils, our advice to farmers is not to throw their cultivators away, but to use 2,4-D spraying as a supplement to normal cultivation procedures.

At rates of ½ lb., 1 lb., and 1½ lb., of 40 per cent 2,4-D acid per acre, potato vines were noticeably affected, yields were reduced slightly; but potatoes sprayed at the lower rates showed a higher specific gravity in the tubers than those from untreated vines.

P. T. Blood
F. S. Prince

Gray Birch in Blueberries Can Be Killed by Spraying. Gray birch is one of the most troublesome weeds in the low-bush blueberry fields, and is difficult to eradicate because of its ability to sprout from the stumps. In an experimental plot of three and one-half acres that was literally covered with gray birch varying in

size from small sprouts to trees three inches in diameter, the weed killer, 2,4,5-T was applied as a spray to the stumps at the rate of two pints per 10 gallons. Cutting was started in May and was continued until July first, the 2,4,5-T solution being applied immediately after cutting.

The stumps on which the material was applied to the sides as well as to the cut surface have not sprouted. Older stumps of fall and winter cutting which were sprayed this spring with 2,4,5-T sprouted considerably. The best technique, as indicated from this year's work, is to apply the 2,4,5-T immediately after cutting, within a few hours, being sure to cover the sides of the stump as well as the cut surface. This was effective even when the stumps were cut as close to the ground as two inches. The technique used was for one or two men to cut the gray birch and a third man to follow up with the hand sprayer.

One gallon of the 2,4,5-T concentrate was enough to treat the stumps on this three and one-half acre experimental plot.

W. W. Smith

Quackgrass Can Be Controlled with Chemicals. During the past two years, a new herbicide known as TCA has attracted a great deal of attention because of its effectiveness in killing quackgrass. The full name of this chemical is Sodium Trichloroacetate.

Experiments carried on by the University of New Hampshire Department of Botany during the past year indicate that TCA is effective under a variety of conditions with late spring and summer treatments. Early spring and fall treatments have not yet been worked out. In light sandy soils quackgrass was nearly completely destroyed when ¼ lb. of the substance dissolved in a gallon of water was sprayed on 100 square feet of infested area. In heavier soils, containing varying quantities of clay, larger amounts of TCA (up to ½ and ¾ lb.) had to be used for effective control. The herbicide is absorbed chiefly from the soil and not through the foliage. Therefore, grass should be mowed before treatment to permit the TCA solution to reach the soil. Our experiments indicate that in moderately heavy to heavy soils the residual effect of the chemical in the soil seems to disappear within a month to six weeks following application.

Most farms have areas where TCA could be tried. The preparation of grass-free strawberry beds, or asparagus beds, and the removal of grass from the borders of gardens which serve as perennial sources of quackgrass infection are a few suggestions for its use.

A. R. Hodgdon

Plant Pathology

New Fungicides for Apple Scab Control. Although a number of fungicides are available for disease-control on fruits, vegetables, and potatoes, there is still need for better ones. The micro-fine wettable sulfurs will control apple scab if adequately applied to the fruits and foliage as protective sprays or dusts; however, as orchard operations do not always make it possible to apply sulfur at the proper time, there is a definite need for materials which have eradicative properties. It is for this purpose that Phygon XL, puratized apply spray, puratized agricultural spray, Tag 331, and others have been advocated. Iron carbamate, now available under various trade names, does not function as an eradicant and has not been as effective as the micro-fine sulfurs for

scab control in our test plots in Durham. It serves a useful purpose, however, for rust control on rust-susceptible varieties such as Wealthy and Winter Banana.

In general, the eradicant sprays mentioned will give more satisfactory scab control than sulfur if they are applied three or four times in the pre-cover sprays. Their use as single-shot sprays to eradicate scab is not recommended. These materials are compatible with nearly all the common insecticides now in use.

M. C. Richards, Francis Racine, and Russell Eggert

Poultry Husbandry

Is Pellet Feeding More Efficient than Mash Feeding? Mash feeding has been compared with pellet feeding for growing pullets from one day to 20 weeks of age. A third group was fed pellets without hoppers after they were three weeks old. At 12 weeks of age, grain was introduced into the ration of all pens and fed in the litter. The pen-fed pullets in hoppers became infected with coccidiosis at about nine weeks of age. This caused about 10 per cent additional mortality. The results, therefore, are only indicative of the differences that may exist.

In view of the coccidiosis condition it would appear that pellet feeding is at least as efficient as mash feeding and perhaps may have a slight advantage. In the pellet-fed groups considerable difficulty was experienced with feather picking but there was little actual loss from cannibalism. Litter conditions were less satisfactory in the pellet-fed pens and, surprisingly, were least satisfactory in the pen fed pellets in the litter.

R. C. Ringrose

Should Replacement Stock Be Raised on High Energy Feed? Three pens of chicks were fed to 12 weeks of age to determine the relative merits of high-energy and regular mash feeds for growing broilers. The high-energy feed was definitely superior in feed efficiency and returned more money over feed cost. The regular mash feed gave a feed efficiency of 3.71 pounds of feed per pound of gain while the two groups fed high-energy feed gave figures of 3.00 and 3.05. Income over feed cost per thousand broilers raised amounted to $448 for the regular mash feed and $574 for the high-energy feed. Mortality was low and varied by less than 1½ per cent.

At 12 weeks, males were removed and the pullets continued until they were 20 weeks of age. Also, at this time, one pen which had received high-energy feed was changed to the regular growing mash. Grain was introduced into the ration of each pen and was fed in the litter.

At the end of 12 weeks the birds which received the high-energy feed averaged 0.4 pounds heavier and had

A Comparison of Feeding Systems at Twenty Weeks of Age

Feeding Systems	Average Weight	Feed per pound of Gain	Mortality
	lbs.	lbs.	Per Cent
Mash	4.57	4.63	5.52
Pellets	4.49	4.69	16.74
Pellets — no hoppers	4.77	4.34	6.05

Results of Growing Pullets to Twenty Weeks of Age

Feed	*Feed Efficiency* 0–12 weeks	12–20 weeks	0–20 weeks	Average Weight 20 weeks	Mortality 12–20 weeks
	lbs.	lbs.	lbs.	lbs.	%
Regular	3.71	5.91	4.63	4.57	0
High Energy	3.00	6.67	4.33	4.83	2.82
High Energy 12 Weeks Regular 12-20 Weeks	3.05	6.51	4.32	4.73	1.59

made efficient use of their feed. However, during the 12- to 20-week period they grew less rapidly and were much less efficient in the use of their feed than those which had received the regular mash from the start. The group which received the regular mash after 12 weeks also grew more slowly and used their feed less efficiently. As the mature weight was approached all groups tended to come to the same weight. Such results are not uncommon with chickens since it is known that, within limits, early rapid growth is followed by a later period of less rapid growth. Mature weight being an inherited characteristic, all groups approach the same weight as they approach maturity. At 20 weeks the high-energy fed birds had lost some of the weight advantage they held at 12 weeks but were still heavier.

Preliminary laying house data from these groups (all receiving the same laying ration) indicate that the pullets grown on the regular mash and the high-energy mash started production at the same time. They also reached 50 per cent production after the same period of time. In contrast, the group which received high-energy mash followed by regular mash laid their first eggs a few days earlier than the other groups. They also required four additional days to reach the 50 per cent production level. There is no difference in egg production after 112 days in the laying house.

R. C. Ringrose

Soybean Oil Meal Is a Good Protein Supplement. Soybean oil meal is the only protein supplement necessary for the production of market eggs. Soybean oil meal can supply the major portion of the protein necessary for growth of chicks and production of hatching eggs, but for best results it must be supplemented with a small amount of protein of animal origin such as meat scrap or fish meal. By supplying most of the supplemental protein from soybean oil meal cheaper rations are obtained.

R. C. Ringrose

Meat Qualities and Egg Production Are Being Combined in One Bird. During the past year, work has continued on the Dark Cornish-New Hampshire cross. A total of 1587 eight generation (F_8) chicks hatched from six single-male matings were pedigreed and their performance will be studied from a family standpoint. Next year's breeders will be selected from the families that gave the best results with respect to egg production, meat qualities, livability, and uniformity.

The trapnested F_7 hens have not completed a year's production, although the production seems to be as high as last year. Last year's highest production in these birds was 237 eggs per year. Twenty-five per cent of the 80 F_7 hens used as breeders hatched 90 per cent or more of fertile eggs and 49 per cent of these hens hatched 80 per cent or more.

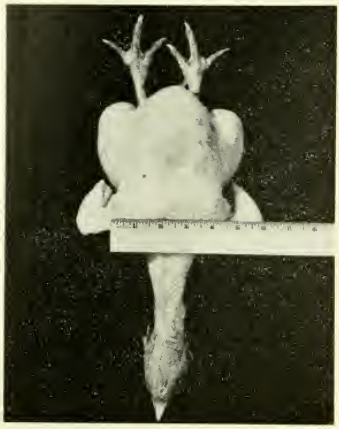

Fig. 9 — The carcass of a White Cornish-New Hampshire cross which laid 182 eggs in 10 months.

After desirable and uniform families are obtained, this stock will be made available to New Hampshire poultrymen. With this in mind, 366 backcross chicks were produced this year by mating four purebred New Hampshire females with each of the six F_7 males. These backcross chicks were heavier at 10 weeks than the F_8 chicks and they were looser feathered (resembling more the female parent) than the F_8 chicks. The backcross chicks were broader breasted and apparently carried more meat than the straight New Hampshires, but they were not as satisfactory as the F_8 birds in these respects.

The White Cornish-New Hampshire cross made last year seems very promising. Egg production is exceptionally good, one hen having laid 224 eggs in 11 months. Fig. 9 shows a hen which had laid 182 eggs in ten months, or the equivalent of 218 eggs in 12 months. It can be noted that the anterior width of the breast is approximately four and one-half inches and that the width carries well to the end of the keel. The keel itself is five inches long and the distance from the posterior end of the keel to a point perpendicular to the ruler in Fig. 9 is eight inches. This certainly indicates that good egg production and superior meat qualities can be combined in one bird.

Fig. 10 shows a White Cornish-New Hampshire male and Fig. 11 a female from this cross. The close feathering shown is typical of the cross. It should also be noted that the birds shown are reddish in color with the normally black areas of the New Hampshire being replaced by white. This indicates the possibility of the presence of that gene which inhibits black but not red in the strain of White Cornish used.

C. W. Hess

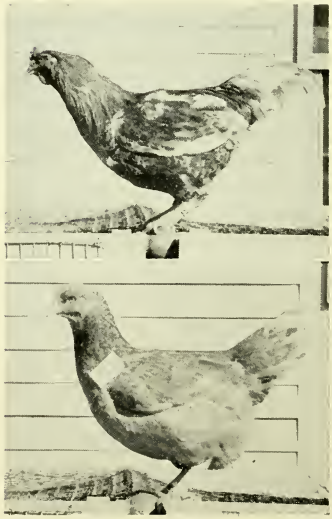

Fig. 10 — (above) A male from a White Cornish-New Hampshire cross.

Fig. 11 — (below) A female from a White Cornish-New Hampshire cross. Note the wing badge which is used to identify the bird while trapnested.

Feed Cost May Be Reduced through Breeding. Reduction of feed cost is of paramount importance to the poultry industry and to every poultryman, large or small. Any reduction that can be brought about through breeding will mean additional profit to the poultryman.

Research is under way in an attempt to identify individuals and families that will utilize their feed more efficiently than others. Individual body weight and feed consumption data are recorded for males and females, as well as egg production data for the hens. Chicks are produced from these males and females and their efficiency is noted.

Results to date show a wide variation between individuals in feed consumption. For example, male B (Fig. 12), weighing 7.76 pounds, consumed 84.65 pounds of feed in 40 weeks in contrast to male D (Fig. 13), weighing 7.69 pounds which consumed only 61.09 pounds during the same period. This difference of 23.56 pounds of feed is equivalent to 30.7 pounds per bird per year. Therefore, for every 65 males similar to male D instead of male B, a saving of one ton of feed per year may be realized.

Fig. 12 — Male B which utilized feed rather inefficiently.

Fig. 13 — Male D which made efficient use of his feed.

A total of 186 chicks was hatched and feed consumption and body weight to 10 weeks were observed. Variations in the proportions of the two sexes and differences in the weight of chickens in different progeny groups render it difficult to draw definite conclusions. However, the work is encouraging and conclusive evidence is anticipated. Inbreeding work has been initiated in an attempt to get more uniformity of the stock. The first pullets from brother-sister mating will soon come into production.

C. W. Hess

Soils

Save that Topsoil. High yields can be obtained only if erosion is prevented. Plots on a Paxton sandy loam from which different amounts of topsoil had been removed to simulate erosion gave the following results in 1948, when in hay:

Amount of Topsoil Removed %	Yield of Hay Pounds Per Acre	
	Unfertilized	Fertilized
100	436	2091
50	1263	2962
0	3920	5009

Similar yield effects were obtained with oats in 1945 and with corn in 1946. It is obvious that fertilization, which included commercial fertilizer, lime, and manure, was not capable of completely overcoming the harmful effects of topsoil removal. Some clues as to why this is so are shown in the following table, which gives some results of physical and chemical analyses of soil samples taken from the various plots.

Amount of Topsoil Removed %	Organic Matter Content %	Water Stable Aggregation %	Non-capillary Porosity %
100	1.18	32.8	15.9
50	2.58	34.9	19.8
0	4.72	48.5	21.3

These results clearly indicate that the properties of the soil which are commonly associated with good tilth and water-absorbing capacity are significantly decreased in value as the topsoil is removed and hence the decreased soil productivity cannot be expected to be overcome by fertilization alone but will also require a building up of organic matter and a re-development of better soil structure. The number of years necessary for this physical process may be considerable, particularly on soils which have a compact subsoil which is low in organic matter.

Therefore, save that topsoil for high yields this year, as well as for the future.

J. B. Bartlett
L. T. Kardos

Does it Pay To Grow Winter Rye as a Cover Crop after Potatoes? The average annual yield of potatoes during the past seven years has been 12 bushels per acre greater on the plots protected with winter rye than on the plots which have been left bare over the winter. The yield benefits from the winter rye have been greater during wet summers than during dry summers and has has averaged about 27 bushels in normal rainfall years.

With the yield benefit there has also been a soil-conserving benefit from the use of winter rye. The average annual soil losses from the bare plots during the past seven years have been almost double that from the winter rye plots. The winter rye has been effective not only while occupying the ground but also in rendering the soil less erosive after it has been plowed in and while the potatoes are growing.

From an analysis of samples taken in 1947 the degree of aggregation of the soil has been found to be slightly greater on the winter rye plots and the proportion of crumb-size aggregates tended to be greater. These properties undoubtedly account in part for the decreased erosiveness of the winter rye plots.

J. B. Bartlett
L. T. Kardos

Boron Needed On Some New Hampshire Crops. An application of boron is necessary for maximum

growth of alfalfa on at least 50 per cent of the soils of New Hampshire according to studies made during the past year. In this study 12 of the major soil series were sampled under virgin conditions and subjected to tests for water soluble and total boron. The A horizons, or top-soils, of half of these series had less water-soluble boron than is regarded as being necessary for proper growth of alfalfa, while three-quarters of the sub-soils on B horizons indicate a deficiency of boron in water-soluble form.

Since alfalfa and other legumes, as well as apple orchards and certain vegetable crops, have relatively high boron needs, this work seems to have a rather wide application.

Samples from the same soil series are now being studied with respect to the status of the potash, magnesium, calcium, and hydrogen. Since much of the state has been, or is being mapped in the Soil Survey, it is hoped to build up a supply of information about the different soil series in order that specific recommendations can be made for their successful fertilization and management.

L. T. Kardos

How Long Does Lime Last? That liming the land is a practice leading to permanent soil improvement is shown by hay yields on the Whenal farm in Greenland, in 1948 and 1949. This land was limed in 1925 and no lime has been applied since. The yields of hay for the two years were as follows:

No lime	2.20 T. per acre
2 T. lime 1925	4.85 T. per acre
4 T. lime 1925	5.40 T. per acre

These yields were obtained on a seeding of red clover made in 1947. The land was plowed, planted, and fertilized uniformly, the only difference being the lime variables that had been applied 22 years before the seeding was made.

F. S. Prince
P. T. Blood

Soil Survey Work Progresses. The Soil Survey of the soils of New Hampshire now completed for six counties, and in progress in one additional county, gives an inventory of the kind, amount, and location of the different soils in the state. In the written report which accompanies the soil map, each soil is described, its crop adaptations are presented, and optimum yields and desirable soil management practices are explained.

Surveys of over two-thirds of the state have been completed, with 6,450 square miles done and approximately 2,450 square miles left to do. Approximately 40 square miles were mapped during the past year in Rockingham county. In cooperation with the U. S. Department of Agriculture, Soil Survey reports have been published for Grafton county in 1939, Coos county in 1943, and Strafford county in January, 1949. Publication of the reports for the Sullivan-Cheshire area are expected during 1949, and for Hillsborough county in 1950.

The Paxton and Marlow soils found in southern New Hampshire are the best soils for apple orchards. These soils are well-drained, loam textured, and developed on egg-shaped (drumlin) hills, affording excellent air drainage. They are also among the better soils for dairy crops.

R. Feuer

State Service

Seed Inspection. The regular seed inspection work for the State Department of Agriculture was conducted as usual. During the year, 3030 samples were handled in the laboratory. Of this number, 625 samples were collected by the State Inspectors and will be reported in Station Bulletin 378; 2,405 samples were sent in by seed dealers in compliance with the clause in the New Hampshire seed law which requires that all vegetable and agricultural seed must have been tested for germination within nine months of being offered for sale. Therefore, much of this testing was seed carried over from the previous season. A few of these samples were sent in by farmers who had grown beans or corn and wished to sell it for seed.

B. G. Sanborn

Inspection of Fertilizers and Feedingstuffs. In accordance with the laws regulating the sale of commercial fertilizers and of concentrated commercial feedingstuffs, 82 brands of fertilizers and 614 brands of feedingstuffs were analyzed for the State Department of Agriculture during the year 1948-49. These analyses involved individual determinations totalling 562 and 3239 respectively .

Co-operation in work on analytical methods with the American Association of Feed Control Officials, with the Smalley Foundation, and with the Association of Official Agricultural Chemists has been continued.

Samples of feeds, fertilizers and other materials have been analyzed for New Hampshire residents. Thirty-nine samples have been examined, involving 142 determinations.

H. A. Davis

Soil Testing. The samples of soil tested for New Hampshire residents totalled 2391.

H. A. Davis

The National Poultry Improvement Plan. A total of 47 states are co-operating with the U. S. Department of Agriculture in administrating the National Poultry Improvement Plan. In New Hampshire, a board of ten poultrymen administer the plan with the co-operation of the University of New Hampshire, the Agricultural Experiment Station, and the State Department of Agriculture.

The Breed Improvement stages of the plan, *i.e.*: Approved, Certified, R.O.P., and R.O.M., are administered by personnel of the University of New Hampshire Department of Poultry Husbandry. Flock inspections were made on each of the 309 farms carrying 863,500 birds that participated in the Approved and Certified stages. In addition, 41 hatchery inspections were made. In the R.O.P. and R.O.M. work there were 14 flocks participating with a total of 11,000 birds. A minimum of five full day inspections per year were made on each of these flocks.

R. C. Ringrose, E. T. Bardwell and Conrad F. Zoerb

Pullorum Testing. A total of 1,386,421 of the poultry population was blood tested during the fiscal year. Because some birds were retested, a total of 1,423,717 samples were examined.

The birds tested were contained in 589 flocks of which five flocks were found to contain a total of 60 reacting birds. Thus, less than 1 per cent of the flocks tested were found to harbor pullorum disease as contrasted to the early days of the pullorum testing program in the late

1920's, when 25 to 35 per cent of the flocks were found to be infected. The 60 reacting birds constitute but .004 per cent of the birds tested.

F. E. Allen, D.V.M.
A. C. Corbett, D.V.M.
G. P. Faddoul, D.V.M.

Infectious Bronchitis and Newcastle Tests and Service. As infectious bronchitis virus is not propagated by any commercial laboratory because of regulations against interstate shipment of the same, it has been necessary for this department to produce this material for the poultrymen of the state. The poultrymen inoculate their birds with the virus and produce the disease and a subsequent immunity. This is done at a favorable period during the growing stage of the bird so that it enters the laying house protected against the production-destroying effects of a natural outbreak of infectious bronchitis. The bronchitis virus is produced in embryonating eggs and after being harvested is kept in a frozen state until called for by the poultrymen. About 300 poultrymen have procured the material during the fiscal year.

Since one cannot absolutely differentiate between infectious bronchitis and Newcastle disease outbreak without resorting to complex laboratory testing we have offered this service to New Hampshire poultrymen. The tests are based on the immune bodies found in the blood stream of the bird after recovery takes place. It is of value, even though the bird has recovered, because it indicates to the poultryman which disease is on his premises. The 589 flocks which were tested for pullorum disease were also checked for Newcastle disease by pooling blood serum from the pullorum blood samples and submitting this to test. In addition, a considerable number of Newcastle tests were conducted on birds submitted for routine autopsy service.

About 25 flocks were checked for their susceptibility or immunity to bronchitis. Embryonating eggs have to be used for this test and it takes a period of five or six days to complete the work.

F. E. Allen, D.V.M.
A. C. Corbett, D.V.M.
G. P. Faddoul, D.V.M.

Diagnostic Service Performed at the Poultry Laboratory. From July 1, 1948 to June 10, 1949, a total of 4026 specimens of all kinds was submitted to the Poultry Laboratory for diagnosis. These represented 1571 diagnoses.

A total of 3822 chicken specimens and 126 turkeys and 13 miscellaneous birds were examined. Forty-four cases, consisting of 65 specimens from various animals, were also handled by the laboratory personnel.

A tabulation of the cases handled follows:

Summary of Poultry Autopsies Performed at the Poultry Pathology Laboratory During 1948-1949

	Based on the Number of Diagnoses	
	Adults	Chicks
Abscess	7	1
Air Sac Infection	4	2
Blackhead		8
Bluecomb	34	6
Breast Blister		2
Brooder Pneumonia		2
Bumblefoot	4	
Cannibalism	5	
Cecal Worms		1
Chronic Respiratory Disease	1	
Coccidiosis, Acute Intestinal	2	17
Coccidiosis, Cecal	1	50
Coccidiosis, Chronic Intestinal	9	36
Colds	2	

	Based on the Number of Diagnoses	
	Adults	Chicks
Colibacillosis	4	1
Conjunctivitis	1	
Constipation	1	
Coryza	1	1
Creosote Poisoning	1	1
Cripples		1
Culls	6	9
Dehydration	1	2
Egg Bound	3	
Enteritis	14	1
Epidemic Tremors		45
Favus	3	
Fowl Cholera	3	
Fowl Typhoid	6	2
Gizzard Erosion		1
Heat Prostration	1	
Hematoma	1	1
Impaction	4	4
Indigestion		1
Infectious Bronchitis	22	29
Infectious Bronchitis (Susceptible)	72	16
Infectious Bronchitis (Immune)	123	14
Infectious Bronchitis (Suspicious)	10	4
Internal Hemorrhage	2	
Leucosis	153	24
Malformation		1
Malnutrition		2
Mismanagement		6
Monstrosity	1	
Necrosis of Beak	2	1
Newcastle Disease	12	6
Newcastle Disease (Susceptible)	184	73
Newcastle Disease (Immune)	47	9
Nephritis	19	1
No Diagnosis	32	29
Obesity	1	
Omphalitis		23
Otitis Media	1	2
Paralysis	3	2
Paratyphoid	1	1
Perosis	1	4
Pericarditis		1
Peritonitis	1	4
Prolapsed Oviduct		2
Pneumonia	3	5
Pullorum	1	4
Pullorum (Examined for, found Negative)	13	1
Pullorum (Examined for, found Positive)	5	
Roundworms	23	2
Ruptured Egg Yolk	39	
Salpingitis	16	
Septicemia		1
Stunted Chick Disease		2
Tapeworms	8	3
Torticollis	1	2
Toxemia		2
Traumatism	26	10
Tuberculosis	1	
Tumor	5	2
Typhylitis	2	
Ulcerated Cornea	1	7
Vitamin Deficiency	1	6
Visceral Gout	12	
Wound Infection		1
Canary		
Enteritis	1	
Game		
Infections Laryngotracheitis	1	
Undetermined	1	
Parakeet		
No Diagnosis	1	
Pea-Hen		
Cecitis	1	
Pheasant		
Blackhead	1	
Enteritis	1	
Overheating	1	
Swan		
Streptococcus Septicemia	1	
Geese		
Coccidiosis	1	
Paralysis	1	
Traumatism	1	
Turkeys		
Aspergillosis		2
Blackhead	2	6
Cecitis		1
Cirrhosis of liver	1	
Coccidiosis		6
Congenital Malformation		1
Conjunctivitis		1
Cripple		1
Dermatitis		2
Enteritis	2	6
Epidemic Tremors		1
Erysipelas	2	
Infections Sinusitis		2
Injury	2	
Leucosis	2	
Necrosis of Beak		1
Omphalitis		3
Pullorum		1
Smothering		1
Spraddle Legs		1
Staphylococcosis	1	
Starvation		1
Undetermined	3	1

SUMMARY

	Number of Diagnoses	Specimens
Adult Chickens	967	2001
Chickens (4 months or under)	495	1821
Adult Turkeys	15	21
Turkey Poults	38	106
Canary	1	1
Game	2	2
Parakeet	1	1
Pea-Hen	1	1
Pheasant	3	3
Geese	3	3
Swan	1	1
TOTAL	1527	3961

BOVINE

	Number of Specimens	Cases
Bovine blood sample — negative for parasites	1	1
Bovine blood sample — undetermined	6	2
Bovine Viscera, exam. for hemorrhagic septicemia — found negative	1	1
Bovine Viscera, Hemorrhagic septicemia	1	1
Bovine tissues, Blackleg	1	1
Bovine calf — navel infection	1	1
Bovine calf — suffocation	1	1
Bovine calf — undetermined	1	1
Bovine calf — pneumonia	1	1
Bovine calf — negative on tissue strain test	1	1
Aborted Feti	1	1
Bovine fecal samples — undetermined	1	1
Bovine fecal samples — Negative for internal parasites	1	1

CANINE

Fecal samples examined for lungworms found positive	2	1
Fecal sample examined for internal parasites found negative	1	1
Skin scraping — negative for mites	1	1

EQUINE

Blood samples — undetermined	2	1
Fecal sample — Strongylidosis	1	1

FELINE

Cat Vomitus — Undetermined	1	1
Cat — Enthanasis	1	1

GOAT

Fecal sample — positive to stomach worms	1	1
Fecal sample — negative to stomach worms	1	1

MINK

Mink — No diagnosis	9	4
Mink — Salmonellosis	2	1

RABBITS

	Number of Specimens	Cases
Rabbit — Ear Mange	2	1

SHEEP

Fecal samples examined for internal parasities found negative	5	3
Fecal samples examined for stomach worms	2	1
Lamb — Gastro Enteritis	1	1
Lamb — Malnutrition and Toxemia	1	1
Lamb — Lack of Nourishment	1	1
Lamb tissue specimens Coli infection	2	1

SILVER FOX

Silver Fox — enteritis	1	1

SWINE

1 pig examined — Traumatism	1	1
2 hogs examined — Hog Cholera	2	1
1 pig examined — Enteritis	1	1
2 pigs examined — Malnutrition	2	1
2 pigs examined — Internal parasities	2	1
Pig tissue — Streptococci infection	1	1

SUMMARY

	Number of Specimens	Cases
Bovine	18	14
Canine	4	3
Equine	3	2
Feline	2	2
Goat	2	2
Mink	11	5
Rabbits	2	1
Sheep	13	8
Silver Fox	1	1
Swine	9	6
TOTAL	65	44

A. C. CORBETT, D.V.M.
G. P. FADDOUL V.M.D.

Mastitis Testing Service. A total of 1,440 quarter samples of milk submitted by New Hampshire dairymen or veterinarians were tested for the diagnosis of bovine mastitis. This represents samples from 385 cows and charges were made at the rate of 25 cents per cow for this service.

L. W. SLANETZ
H. C. MOORE

Other Active Projects

Because the results obtained in any one year from each of the numerous research projects are not always of sufficient importance and magnitude to warrant their detailed presentation in this report, certain of them are listed by title only. Those projects that have not been discussed in this report with the names of the research workers involved are listed below.

Quality, maintenance of quality, and consumer information as factors in costs, sales, and returns in marketing certain fruits and vegetables. *L. A. Dougherty*

Intermarket price relationship for milk and dairy products in the Northeastern milk markets. *J. R. Bowring and J. C. Holmes*

Marketing of hatching eggs. *L. A. Dougherty and J. C. Holmes*

Factors relating to marketability and returns for small fruit. *L. A. Dougherty*

Management problems in the use of mow hay driers. *J. C. Holmes*

Pricing eggs on New Hampshire markets. *J. R. Bowring*

The influence of herd management practices in the University of New Hampshire dairy herd on milk production and breeding efficiency. *K. S. Morrow*

Supplemental vitamin D for dairy cows. *H. A. Keener*

Effect of vitamin D on the utilization of energy and protein by cows. *N. F. Colovos and A. D. Littlehale*

Studies of insects affecting spruce. *J. G. Conklin*

The control of apple maggot and certain other economic insects. *J. G. Conklin*

Studies of synergists for insecticides. *R. L. Blickle, J. G. Conklin and W. J. Morse*

Determination of the supply of low-grade wood available for manufacture into plastics. *L. C. Swain*

Possibilities of propagating high sugar-producing types of sugar maples. *C. L. Stevens and S. Dunn*

Forest reproduction studies. *C. L. Stevens*

A study of white pine stands. *C. L. Stevens*

Spruce reproduction studies. *C. L. Stevens*

Nut improvement. *A. F. Yeager*

Improvements of ornamental plants. *E. B. Risley*

The use of malling and other apple root stocks as means of obtaining semi-standard apple trees. *W. W. Smith*

The flora of New Hampshire. *A. R. Hodgdon*

Plant disease investigations. *M. C. Richards*

Choline in the nutrition of poultry. *R. C. Ringrose*

Expenditures for the Fiscal Year Ending June 30, 1949

	Hatch	Adams	Purnell	B-Jones	Research and Marketing 9(b)1-9(b)2	9(b)3	Supplementing
Personal Services	$13,409.56	$14,033.11	$58,261.45	$6,893.66	$20,302.81	$2,508.93	$33,601.02
Travel	88.12	89.82	340.70	463.47	1,352.82		4,071.55
Transportation of Things		7.76	11.09	14.49	30.36		191.99
Communication Service	182.43	9.45	16.25	5.30	43.85		539.33
Rents and Utility Services	1,000.00		95.00			270.00	
Printing and Binding	125.01		16.59		30.55		1,229.55
Other Contractual Services	74.05	257.51	172.39	96.43	961.05	490.04	792.61
Supplies and Materials	64.09	317.25	862.78	507.05	1,421.95	935.96	7,065.39
Equipment	56.74	285.10	223.75	1,944.90	1,359.95		5,273.25
	$15,000.00	$15,000.00	$60,000.00	$9,925.30	$25,503.34	$4,204.93	$52,764.69

Income for Supplement Expenditures:

State Money Offsetting Federal Funds	$27,541.58
State Money for Station	10,909.03
Research Sales	14,3314.08
	$52,764.69

PUBLICATIONS

Bulletins

Smith, T. O., and Davis, H. A. *Inspection of Commercial Feedingstuffs. No. 373.*

Sanborn, Bessie G. *Results of Seed Tests for 1948 No. 374*

Smith, T. O., and Davis, H. A. *Inspection of Commercial Fertilizers. No. 375*

Chandler, Robert F., Jr., *Science Serves New Hampshire Agriculture. No. 376*

Circulars

Keener, H. A., Colovos, N. F., Morrow, K. S., Foulkrod, G. M., Percival, G. P., and Prescott, J. R. *The Relative Value of a Forage Preserved by Ensiling, Mow Curing, and Field Curing. No. 77*

Woodworth, H. C., *A Farm Plan For a Commercial Dairy Enterprise. No. 78*

Perry, E. C., *Chore Practices on New Hampshire Commercial Poultry Farms Part II Pullet Replacements. No. 79*

Research Mimeographs

Bowring, J. R., *Seasonal Milk and Associated Milk Price Problems. No. 4*

Other Scientific Publications

Prince, F. S., and Blood, P. T. *The Effects of 2,4-D on Potato Tops and Tubers When Sprayed at the Full Bloom Stage. Agron. Jour. 41: May, 1949*

Keener, H. A., Percival, G. P., Morrow, K. S., Ellis, G. H. *Cobalt Tolerance in Young Dairy Cattle. Journ. of Dairy Sci., 32: 527-533. 1949*

Phillips, T. G., and Loughlin, M. E. *Composition and Digestible Energy of Hays Fed to Cattle. Jour. of Agri. Res., 78: 389-395, 1949*

Ringrose, R. C. *Nutritive Properties of Torula Yeast for Poultry. Poultry Science* 28: *75-83. 1949*

Teeri, A. E., and Josselyn, Dorothy. *The Effect of Certain Sulfonamides Upon Lactobacillus Arabinosis in a Nicotinic Acid-Restricted Medium. Jour. Biol. Chem. 177: 23-27. 1949*

NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION STAFF
1949-50

ADMINISTRATION

Robert F. Chandler, Jr., ph.d., Dean and Director
Harold C. Grinnell, ph.d., Associate Dean and Associate Director
Russell C. Smith, Purchasing Assistant
Walton E. Devine, Assistant Treasurer
Ella S. Bowles, Publications Editor
Harold W. Adams, b.s., Assistant Editor for Agriculture and Home Economics
Thelma Brackett, a.b., Librarian
Wilfred T. Harwood, Library Assistatnt in Charge, Plant and Animal Sciences Library

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Thomas G. Phillips, ph.d., Chemist
Stanley R. Shimer, m.s., Assistant Chemist
Gordon P. Percival, m.s., Assistant Chemist
Helen J. Purington, ph.d., Assistant Chemist
Arthur E. Teeri, ph.d., Associate Chemist
Henry A. Davis, m.s., Assistant Chemist
Margaret Loughlin, a.b., Assistant in Agricultural and Biological Chemistry
Dorothy Josselyn, Assistant in Agricultural and Biological Chemistry
Roslyn E. Kramer, a.b., Laboratory Assistant in Agriculture and Biological Chemistry

AGRICULTURAL ECONOMICS

Harry C. Woodworth, m.s., Agricultural Economist
Winifred K. Burkett, ph.d., Associate Economist
Lawrence A. Dougherty, b.s., Assistant Agricultural Economist
James R. Bowring, ph.d., Assistant Agricultural Economist
John C. Holmes, a.b., Research Assistant in Agricultural Economics
William Wallace, b.s., Graduate Assistant in Agricultural Economics

AGRICULTURAL ENGINEERING

Bernard C. Rines, bsae and e.e., Associate Agricultural Engineer
Arthur G. Fox, Jr., bsae, Assistant Agricultural Engineer

AGRONOMY

Ford S. Prince, b.s., Agronomist
Leroy J. Higgins, b.s., Associate Agronomist
Louis T. Kardos, ph.d., Associate Agronomist
Paul T. Blood, m.s., Assistant Agronomist
Reeshon Feuer, b.s., Soil Survey Assistant
Bessie G. Sanborn, Seed Analyst
Walter H. Lyford, m.s., Soil Surveyor

BACTERIOLOGY

Lawrence W. Slanetz, ph.d., Bacteriologist
Arthur F. Howe, ph.d., Assistant Bacteriologist
Fred E. Allen, d.v.m., Veterinarian
Charlotte H. Langley, b.s., Laboratory Assistant
LeRoy E. Scarce, b.s., Graduate Assistant in Bacteriology

BOTANY

Albion R. Hodgdon, ph.d., Plant Taxonomist
Stuart Dunn, ph.d., Plant Physiologist
Mathias C. Richards, ph.d., Plant Pathologist
Charlotte G. Nast, ph.d., Plant Cytologist
Leonard P. Wolfe, b.s., Graduate Assistant

DAIRY HUSBANDRY

Kenneth S. Morrow, m.s., Dairy Husbandman
Harry A. Keener, ph.d., Associate Dairy Husbandman
Herbert C. Moore, m.s., Associate Dairy Husbandman
N. F. Colovos, m.s., Associate Animal Nutritionist
A. D. Littlehale, Herdsman
Frank Wright, b.s., Graduate Assistant

ENTOMOLOGY

James G. Conklin, ph.d., Entomologist
Robert L. Blickle, ph.d., Assistant Entomologist
Wallace J. Morse, b.s., Research Chemical Assistant in Entomology

FORESTRY

Clark L. Stevens, ph.d., Forester
Lewis C. Swain, m.f., Associate Forester

HOME ECONOMICS

Francis Platts, m.ed., Research Assistant in Home Economics

HORTICULTURE

Albert F. Yeager, ph.d., Horticulturist
Elwyn M. Meader, m.s., Associate Horticulturist
L. Phelps Latimer, ph.d., Associate Horticulturist
William W. Smith, ph.d., Associate Horticulturist
Russell Eggert, m.s., Supt. Horticultural Farm
Edward B. Risley, b.s., Greenhouse Supt.
Robert Goodman, b.s., Graduate Assistant
Charles C. Jack, b.s., Graduate Assistant

POULTRY HUSBANDRY

Richard C. Ringrose, ph.d., Associate Poultry Husbandman
Fred E. Allen, d.v.m., Veterinarian
Alan C. Corbett, d.v.m., Pathologist
C. W. Hess, ph.d., Geneticist
George Faddoul, ph.d., Assistant Pathologist
E. T. Bardwell, R. O. P. Supervisor
C. F. Zoerb, Poultry Inspector
Richard Ford, Supervising Technician in Poultry Laboratory
Donald S. Cross, Senior Laboratory Technician in Poultry Husbandry
Virginia LaChance, Laboratory Technician in Poultry Husbandry
Kathryn Moore, Assistant Laboratory Technician in Poultry Husbandry

CHANGES IN PERSONNEL

Additions to Staff

John B. Bartlett, Assistant Agronomist, February 1, 1949

Richard Foley, Graduate Assistant in Horticulture, October 1, 1949

Virginia Wooster LaChance, Laboratory Technician in Poultry Husbandry, July 1, 1948

Frances Platts, Research Assistant in Home Economics, September 1, 1948

Constance Rollins, Laboratory Instructor in Bacteriology, September 1, 1948

Shirley H. Roseman, Laboratory Assistant in Agricultural and Biological Chemistry September 16, 1948

Leonard Wolfe, Graduate Assistant in Botany, September 1, 1948

Losses from Staff

Allen Atwood, Research Assistant in Agricultural Economics, December 31, 1948

T. B. Charles, Poultry Husbandry, January 31, 1949

Richard Foley, Graduate Assistant in Horticulture, May 31, 1949

George M. Foulkrod, Agricultural Engineer, June 23, 1949 (death)

James Macfarlane, Greenhouse Assistant, February 28, 1949 (retirement)

William Mitchell, Graduate Assistant in Agronomy, June 30, 1949

J. R. Prescott, Research Assistant in Dairy Husbandry, June 30, 1949

Ralston Read, Jr., Graduate Assistant in Bacteriology, June 4, 1949

Constance Rollins, Laboratory Instructor in Bacteriology, June 30, 1949

Todd O. Smith, Associate Chemist, June 30, 1949 (retirement)